THE HUMAN CONSEQUENCES OF OFFICE AUTOMATION

GEORGE M. RANKIN

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by

George M. Rankin, Jr.
Lieutenant Commander, U. S. Navy

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Thesis directed by
Arlin Rex Johnson, Ph.D.
Professor of Business Administration

TABLE OF CONTENTS

INTRODUCTION

Management becomes so involved in the technical problems of organizing and planning for a computer installation that many times the human side of the program is neglected. Executives must not overlook the fact that an automatic data-processing system may bring about as radical a change in the office worker's way of life as it does in the company's way of business.

The office worker, as well as the production worker, no longer fears becoming a common slave. None the less, today's technological change and automation frighten him. The mere mention of the word "automation" or "computer" causes anxieties in the minds of the unsophisticated office worker. These apprehensions are understandable when we recall many headlines and stories that have appeared in our daily newspapers - "Will Automation Threaten Your Job?" "Office Automation: Friend or Foe," "One Computer Does The Work of Fifty Office Workers."

New York economist Peter F. Drucker was quoted in March of 1959 by the Wall Street Journal as stating that "automation may bring about more large scale labor displacement in office jobs than in any other field of employment." A remark such as this is not soon forgotten.

It has been fourteen years since the first computer emerged upon the business scene. Initial effects are beginning to give way to

more permanent ones. Experience with computers, perhaps more than with any other technological advance, points out that we have gone through a period of exhilaration, followed by apprehension, which have given way to a sense of frustration. This frustration is the result of the optimistic and often unwarranted claims that have been made about the computer.

When business computers first appeared in 1948, many a normally level-headed businessman just could not resist the sales claims of the manufacturers. The computer became a status symbol. Truly, this mass of wire, solder and vacuum tubes became management's problem-solving "fair haired boy."

The expectations of saving time, cost and labor have proven, as we shall see, in many cases to be unrealistic. Today most experts argue that the computer has become the whipping boy for both management and labor. This disappointment stems from missuse of the equipment, as well as the sometimes overlooked fact that increased mechanization is not always economically sound. Here too we have a "point of diminishing returns."

Despite these factors, the invasion of the computer into the business office is well underway and will continue despite our reservations regarding it. It is time to take stock of its effects on business in general and personnel policies in particular, replacing the exaggerated hopes and fears of the early days by a more realistic evaluation.

This paper will discuss a small segment of this complex problem: office automation.

CHAPTER I

BACKGROUND

Progress has been measured by the development of systems and machines, designed to accomplish a given task cheaper and more efficiently than had been done previously. As our requirements and social structure changed, new systems were developed to cure the ills of the old one. No system seems to be perfect. There are always new challenges to be met as new generations take their place in society.

The influence of automation on every aspect of our modern life is now widely recognized. It is strongly apparent that we are only on the threshold of a new era which will in many ways affect our way of life.

What is Automation?

Since the term "automation" was coined, there has been a great deal of controversy concerning the suitability of the term, as well as how it should be defined to cover all the implications of this new development in technology. Management sees it as a new control device leading to a new philosophy of management. The labor unions envision it as a Frankenstein monster intent upon destroying people by destroying their jobs. These points of view are, needless to say, shaded by emotion and prejudice. It may be safe to say that automation is any

continuous integrated operation that uses electric or electronic equipment to control the quantity and quality of production. The human operator as we know him is eliminated from the production process. This means the elimination not merely of physical labor, which has for the most part been eliminated by mechanization, but also the brain work of the operator regulating the various stages of the production process. The idea, then, is to dispense with the human link in the productive chain. Man's role is therefore confined to supervising the proper functioning of the computer.

The man and machine relationship is much different than it was just a few years ago. Many people today feel we are beginning the second "industrial revolution." There has been more technological knowledge gained since World War II than in all previous history, and the growth is accelerating. Technology is closing the time gap between theory and invention. As a well known British philosopher indicated, in the past human life was lived in a bullock cart; in the future it will be lived in an airplane; and the change of speed amounts to a difference in quality.

The question arises as to what methods automation employs in order to change our man and machine concept. If there had been no hint of methods until quite recently it could be attributed to some new fundamental principle. But this is far from being so. The introduction of the typewriter, one of the earliest labor-saving devices, caused a change in the method of doing work, as well as a shift in the work force. The use of handwritten documents gave way to the typed page and a method

of obtaining numerous copies through the use of carbon paper. Later came the dictaphone, which allowed the stenographer to type directly from the spoken word. Also, about the same time, the office bookkeeping machine appeared on the scene. This advance spelled doom for the black sleeve guards, the green eye shade and the quill pen. Computers today are replacing the bookkeeping machines and supplying management with information faster and more efficiently than ever before.

The Office

What is an office? The office is a many-sided entity. Views of it differ with background and responsibility. At first thought it might be considered a place where typing, filing and record-keeping take place. Yet the bounds of the office extend beyond these normal functions. Today there is a fine line between what is called the office and many other sections of the business.

Broadly speaking, the office is the information producing area of the business. The key to the definition is the word information. Information can be considered both the raw material and the finished product of office operations. Information handling then becomes synonymous with office work.

With any business, information handling exists in many forms. The clerk who writes out a sales order; the bookkeeper who posts to a ledger; the stenographer who types a letter; and the office manager who approves the payroll, are all the standard handlers of information. Looking deeper, information handling includes the freight train conductor who fills out a report on a moving caboose; the truck driver who maintains

time records; the material records and inventories; as well as the executive who analyzes budget requests; and the sales manager who plans for a new promotional campaign. Therefore, it can be seen that the handling of information extends beyond the door marked "office" and the rows of desks occupied by pretty girls. The office exists anywhere within the organization where information is collected, processed or used in the administration of business affairs.

The office of today handles and processes information and then utilizes it. Automation is affecting each of these areas of office work. The result can only be a higher level of business effectiveness.

The initial handling of information includes not only the collection of data but its entry into the data-processing system. Data collection occurs from many activities, such as a salesman's order book, a receipted utility bill or a purchased railroad ticket. The results of these transactions must then be made available for data-processing in such form that the entry into the system will be handled without recopying. This operation alone cuts clerical costs, time and further insures quality by greater accuracy. Each time an item is copied the chance for human error enters the picture.

Information or data-processing is the second component of office work. It includes the operations performed on information within the office system as a whole. These operations are either simple repetitive clerical tasks or more complex analysis or evaluation problems.

The repetitive clerical activity includes diverse tasks - posting to ledgers, totaling sales checks, computing sales discounts,

or making file references. File searching for information is an important link in most clerical systems. Verifying the current balance in a checking account, determining addresses of customers or locating past correspondence are all examples of file searching or reference tasks. In these areas we find electronic machines can make more efficient and reliable the data-processing function in the office.

The analysis of business information involves either nonroutine or complex operations. For example, comparing actual expenditures against the budget, determining the cost of production of an item or computing trends and cycles. In this area we find the mathematics of the business on which most of the financial control is based. Here also electronic machines are far superior to man, due to the speed of calculation and of comparison.

The distribution of information is the final step in the data-processing operation. The tangible results of the clerical and analytical phases are now communicated to the areas of interest. These results are in many forms, but normally in the form most useful for the main recipient. Such reports as inventory levels, sales analyses, or production schedules are excellent examples. Here also, the electronic machine with its high-speed printing capability, coupled with the newly developed high-speed wire and microwave communications systems, insures that the processed data arrives at the point or points where it can best be utilized.

Putting the processed information to work is the third component of the office. Management policy and control is based on the generated

information. Thus, information serves the purpose of motivating actions and decisions. These actions or decisions may be within the organization or without, with customers, creditors, competitors, or some other economic force. Let us not confuse ideas here. The tools for decision-making are provided to management, and management must then make the decisions. The office does not make decisions, but provides management with the tools on which to base those decisions. Effective management requires an effective office information system.

The Evolution of the Office

The raison d'etre of the office is data-processing or information handling, as it is sometimes called. The information when collected is handled in one of three broad ways: that is, classifying, computing and recording. The data-processing functions themselves, taken as a whole, comprise only one of several major office processes, the others being data-inspection, data-storage and data-transportation. Data-processing, however, has been the core of office processes and is the most complex. It has also been the object of attention as well as improvement for many, many years.

Office automation has occurred in stages or eras, even though in some cases the stages overlap. Each one of these stages - manual, mechanical, punched card, paper tape and now electronic - has had its distinctive impact on the data-processing functions and on administration.

In the manual stage, which has long since passed by the wayside, the functions were usually separate and distinct. For example, documents were normally sorted or classified before they were independently

computed or recorded. The mechanical stage, in contrast, introduced the combination of two or more functions within a single operation. For example, adding machines both compute and record; bookkeeping machines also compute, summarize and record.

The adding machine had its real beginning in 1642 when Blaise Pascal invented his Machine Arithmetique, a device for automatic addition and subtraction. Prior to this time, other simple multiplying devices were invented, such as the Chinese abacus and Napier's rods, but these were not machines as we think of them. A genuine multiplying machine did not make an appearance until 1670. Gottfried Wilhelm Von Liebniz adapted the principle of Pascal's adding machine and multiplied by repeated addition, just as the electronic computer does today. But, in spite of these inventions, calculators were almost unknown in the offices of the 17th century. The first practical commercial calculator was not marketed until 1820, when Thomas de Colmar of France introduced his Arithometer.[1]

The punched card stage brought about communication between similar machines. This "native" machine language consisted of patterns of holes in cards which could be understood or read by similar machines. A given set of punched cards will activate a machine which will compute and record, sort and add, and interfile the punched cards into a deck of similar cards. The originator of the punched card machine was an

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[1]The following background data was gathered from various sources, such as histories, encyclopedias and unpublished material found in files.

employee of the United States Census Bureau, Dr. Herman Hollerith. In 1897 Dr. Hollerith devised a punched card adding unit to process census statistics. This was not the dawn of punched card equipment, however. About a century before, in 1801, Joseph Marie Jacquard utilized punched cards to activate an automatic loom. The holes in the card contained the weaving pattern. This system permitted diverse and intricate patterns to be produced cheaply and accurately. Within ten years of its introduction more than 10,000 card-activated looms were operating in France.

The fourth evolutionary stage was that of paper tape, which allowed intercommunication among machines that formerly were unable to communicate with one another. Prior to this time, raw data could not be transferred from the typewriter to punched card equipment. The human factor had to be interjected into the process, i.e., a key punch operator was needed to create a deck of cards from the data produced on the typewriter. The operator was what we might call an interpreter between the "native" languages of the typewriter and the punched card machine. Punched paper tape introduced a new machine language.

In 1870 Jean Baudot, a French government worker in the Ministry of Posts and Telegraphs, perfected a punched tape containing a series of holes in vertical columns. Each column had five holes. This was first used in telegraph machines but soon advanced to office machines. Typewriters, calculators, bookkeeping machines, telegraph equipment and punched card equipment were now able to be functionally integrated into a single data-processing system. For this reason, the common

language concept of paperwork management is often referred to as IDP (Integrated Data-Processing).

The latest stage in the evolution of office automation, EDP (Electronic Data-Processing), introduced intercommunication among data-processing functions in a single machine at fantastically high speeds. This system enables us today to perform a complex series of data-processing operations automatically once the machine has been programmed. A brief description of the electronic digital computer will illustrate the point.

The digital computer has five components: input, memory, arithmetic, control and output. The input may be punched cards, punched paper tape, magnetic tape or direct typing equipment. The memory unit, which stores information until it is ready for use, consists of either a magnetic drum, a magnetic core or magnetic tape. The arithmetic unit adds, subtracts, multiplies, divides, compares, makes logical choices between alternatives and is capable of intercommunication with the "memory." The control unit, which also can communicate with the "memory," stores the instructions for the arithmetic unit. The output is normally documents and reports, but also can be punched cards, punched paper tape or magnetic tape.

The digital computer was a product of World War II, and was used to satisfy military needs for trajectory and ballistics tables, as well as for atomic research. Today we find it not only in the research field but in the production line and clerical office as well. The concept is not really new. Over 100 years ago Charles Babbage, an

English mathematician, designed a general purpose computer which he called an "analytical engine." This was a mechanical computer, and due to the technical limitations of his era, Babbage was never able completely to build his computer.

The computer is constantly being modified and refined to adapt it to the varied changing requirements of business, government and industry. The march toward fully-automatic offices has steadily increased in tempo over the past 300 years.

Why Office Computers?

As shown previously, men have strived to invent processing equipment which would reduce the human effort, as well as provide efficiency in the processing of information. Today the computer is becoming part of our everyday life. Management must have available current, concise information in useable form to stay competitive in our present day business community.

Businesses are growing larger and more complex as our population and economy grow. The computer has become a must in such organizations since it insures that all aspects of the business are known. Our mechanical systems of yesterday were not capable of providing the critical facts necessary to control operations. Many decisions were made not based on facts, but on the intuitions of the manager. Further, management is concerned mainly about areas that are unpredictable, as well as the areas that are not functioning according to the overall plan of the organization.

Office automation also adds to a calmer business life for management.

These automatic devices never go on strike; are never absent from work without a reason; do not require constant training; do not ask for pay raises; nor do they complain about working conditions. Also, they, for the most part, can work better, faster and more safely than people, and can do many things that humans cannot do. For example, they do not suffer from fatigue or monotony and in most cases are much more dependable, making fewer mistakes and are never forgetting.

The computer can fill all these management requirements. This is the basic reason for the growing trend of office automation. A few years ago arguments used by many to gain access or control over a computer were based on their labor-saving aspects. Now these complex pieces of hardware are desired by management. Not only does the computer save on personnel, but it is capable of providing management with information which until recently was unobtainable.

Computer Myths

In the past fourteen years of their broadened use, businessmen have not really gotten down to brass tacks in determining what the computer will do for them. They have in many cases been fascinated by the equipment. John Diebold in his testimony before the Holland Committee says that millions of dollars have been spent for new equipment that is really doing nothing that the old equipment it replaced was doing more easily and more economically.[2] For example, a car body manufacturer

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[2]U.S., Congress, House, Subcommittee on Unemployment and the Impact of Automation, Hearings, Impact of Automation on Employment, 87th Congress, 1st Sess., 1961, p.68.

desired to automate his assembly line. The equipment was purchased from different suppliers without proper coordination or study. The machines did not work properly, so the old system had to be set up parallel to the new automated one. In the course of a few years the entire plant was closed at a loss of about 10 million dollars. A utility company spent four years preparing for a computer that was expected to do a certain job for them in twenty hours. As it turned out, after the equipment was installed the job took sixty hours and the machine had to be returned.[3] Many fiascos such as this resulted because management's thinking about automation has already become rigid and cluttered with misconcepts which stand in the way of real progress.

According to Mr. Diebold the principal misconceptions are "(1) that automation is primarily a labor-saving device, (2) that the ultimate in automation can be symbolized by an oil refinery or any other highly instrumented process plant, (3) that because automation is highly technical most of the decisions concerning it must be left to engineers and technicians, (4) that only companies with large dollar resources and exceptionally long runs of product can afford to automate."[4]

Over the years these misconceptions have "grown like Topsy." A recent study made by the Bureau of Labor Statistics indicates that the

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[3]National Planning Association, Automation: Its Impact on Business and Labor, A Report Prepared by John Diebold (Washington, D.C.: National Planning Association, 1959), pp.4-5.

[4]Howard B. Jacobson and Joseph S. Roucek (ed.), Automation and Society, (New York: Philosophical Library, 1959), p.314.

results of introducing electronic data-processing did not in all cases meet the company's initial objectives.[5] Of the twenty companies studied, the objectives were primarily cost savings from greater productivity, both of labor and capital. Thus a majority of the offices ranked clerical labor savings as their most important objective. (See Chart I-I.) By this they meant increasing clerical output with the same amount of labor and not necessarily a reduction in office employment. However, they found that they were able to process an increased workload faster and more accurately than before, as well as to obtain information hitherto not available. For example, an airline used an electronic data-processing system to calculate the best method of rescheduling the day's operations after an aircraft breakdown. The results returned a six million dollar savings per year by reducing the number of standby aircraft and crews, thereby increasing aircraft utilization. The labor saved in the process was strictly a by-product.

Another misconception - that the ultimate in automation is the highly instrumental plant - is also not true in every respect. In completely automated plants the quality control of the variables in the process must be done normally. The computer still cannot think, smell or feel. Constant manual supervision is required to maintain the required level of quality.

Mr. Diebold further observes that management is not only fascinated

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[5] U.S., Bureau of Labor Statistics, Adjustments to the Introduction of Office Automation, Bulletin No. 1276, (Washington, D.C.: U.S. Government Printing Office, 1960), p.10.

CHART I-I

MANAGEMENT'S OBJECTIVES IN INTRODUCING ELECTRONIC DATA-PROCESSING, BY ORDER OF IMPORTANCE

OBJECTIVE	OBJECTIVES, BY NUMBER OF COMPANIES AND ORDER OF IMPORTANCE*		
	FIRST	SECOND	THIRD
Clerical Laborsaving	11	5	-
Equipment Saving	4	1	1
Space Saving	2	-	1
Time Saving	2	3	6
Greater Accuracy	2	5	4
Overcoming the Clerical Labor Shortage	2	2	3
New Information	-	2	4

*Some of the twenty companies listed several objectives as of equal importance.

U.S., Bureau of Labor Statistics, Adjustments to the Introduction of Office Automation, Bulletin No. 1276, (Washington, D.C.: U.S. Government Printing Office, May 1960).

by automation machinery, but also is intimidated by its complexity. Technicians have in many cases taken over not only the machinery operation but management decisions as well. Businessmen tend to overestimate the specialized knowledge required adequately to control the process. Glenn White of the Chrysler Corporation says, "Somebody who has a good knowledge of how to run a business.....can be trained in electronics much easier than somebody who knows electronics can be trained in how to run the business."[6]

Again, Mr. Diebold disputes that idea that automation requires a lot of money. Automation can be used by companies with short production runs. Automatic machinery can be used to concentrate on a few types of products. Also, computer services are available now in computer centers similar to a laundromat. A few small companies have banded together and formed a computer division so as to reap the benefits of office automation at a reasonable cost. Management, in many cases, views automation as the sum of specific machines. It is more than that. It is an integrated process with a new set of principles and concepts.

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[6] Wall Street Journal, March 28, 1961, p.1.

CHAPTER II

THE EFFECTS OF OFFICE AUTOMATION

Automation appears to be the third phase in the development of a technology that began with the industrial revolution of the 18th century. First came mechanization, which created the factory system. Labor and management were really two separate groups. Also in this period came a shift in the population from the rural areas to the towns. In the early 20th century mass production brought forth assembly line operation and its related machinery. This machinery was so expensive that many family-owned enterprises were forced to become divorced from management thru the issuance of corporation stock. Today most corporations are owned by hundreds of stockholders. Finally, since World War II, automation has added the elements of automatic controls and decision-making. This turned the factory from a collection of mass machinery connected by the human worker into a single integrated unit capable of producing on an enormous scale. Mass production was a technology based on principles of organization. That is to say, organizing the work flow based on machine output. Automation carries one step further; that is, a technology based on communication and control.

Automation is based on all of the principles of these stages of technological growth. It embodies the mechanization of the 18th century,

the mass production principle of the early 20th century and utilizes the automatic control principles developed during World War II. But automation is more than a technology. It is a concept of production, either of tangible items or information for control. The entire productive process, from raw material to finished product, affects every level of the operation.

Production Effects

Automation has had its biggest and most immediate impact in the office rather than in the factory or in the processing plant. As discussed earlier, offices process raw material - information. Just as automatic production machines have speeded and improved industrial processes, automatic "white collar" machines in the form of electronic computers are doing the routine, time-consuming tasks of the office.

Computer Sciences, Inc., estimated in recent hearings before Congress that 10,000 computers were installed in 1961, and that this figure will be doubled in 1962.[1] Computers in the office are going to be like bulldozers in the construction industry. All the experts agree that the office, as described earlier, is ripe for this revolution. Since the beginning of this century the ever-increasing demand for more paper work (information) has caused business to hire an ever-increasing number of clerical workers. As shown later, the supply has not kept pace with the demand. One insurance company which installed a computer

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[1] Hearings, Impact of Automation on Employment, op. cit., p. 406.

to handle some of its paperwork has, for fifteen years, been recurrently short of clerical help.

The increased use of data-processing equipment promises to alter this situation. Computers today can handle just about all office chores, from payroll tabulation and billing to market analysis. For example, Pan American Airways uses an IBM computer for passenger and cargo revenue accounting. American Airlines handles plane reservations with a device called the "reservisor" which holds a record of all seats available on 1,000 flights for a ten-day period, and shows at the push of a button which flights have vacancies for a given destination on a given date.

The Federal Aviation Agency is currently installing a National Air Traffic Control System using the latest techniques in communication, computers and data-processing equipment to handle the increased air traffic and the complications that the jet era introduces. Many banks now use computers to do all the required data-processing in maintaining accounts, as well as their trust activities. Curtis Publishing Company now has all its subscription data computerized so that it can print one million addresses per day.

Computer centers are springing up throughout the nation overnight. These centers are making it a simple matter for a small company to utilize the efficiencies of computer operation at a reasonable cost. Automation Magazine, in its March 1961 issue, listed these new centers and described their operation. These centers operate along the same lines as a laundromat. The client solves his own problems with a

minimum of instruction. If assistance is needed there is an experienced staff to help in the preparation of programs and in machine operation.

A few medium size companies have banded together and set up a computer center to handle all their accounting, billing, inventory control, et cetera. In this type of operation all of the companies contribute to the total cost of the operation. Since the combined operation is a separate organization, there is guaranteed secrecy of confidential company information.

There is no doubt that computers - small, medium and large - will continue to take over more and more office work. They will, in doing so, do a faster and more accurate job than clerks could ever do. As our companies increase in size and as competition grows, so is there increased need for current, accurate and up-to-date information. Management of the near future will require such information in order to make decisions which are essential for effective timely control.

The Changing Clerical Force

Early in 1959, it was estimated that 2,000 electronic computers of all sizes were being used for a variety of business, scientific and engineering purposes, by both private companies and government agencies.[2] International Business Machines Corporation recently publicly announced that they have a total of 4,000 model 1401 computers on back order. These figures will give us an insight as to the numbers we are discussing.

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[2]Joseph R. DeParis, "A New System," Data Processing, March, 1960, p. 19.

Needless to say, the number and use of computers is steadily growing.

Many articles and publications give the impression that the era of the clerical worker is past and that the number is decreasing. According to the United States Department of Labor Bulletin Number 1276, this is not the case. Clerical occupations as defined by the Bureau of Labor are file clerks, bookkeepers, office machine operators, cashiers, typists and others engaged in various types of data-processing.

In February 1960, about 9.6 million persons were employed as clerical workers. At this point in time the number of people involved in clerical pursuits has been growing at a faster rate than the labor force. As indicated in Chart II-1, one out of every seven workers today is in clerical occupations, contrasted to one out of every twenty workers in 1910. While the rate of increase is declining, clerical employment is still increasing at a faster rate than the workforce as a whole.[3]

CHART II-1

PERCENTAGE OF CLERICAL WORKERS TO THE TOTAL LABOR FORCE

Year	Percentage	Clerical Workers to Labor Force Relationship
1910	5%	1 in 20
1940	10%	1 in 10
1950	12.5%	1 in 8
1960	14.3%	1 in 7

Source: Bureau of Labor Statistics, May 1960.

[3] Adjustments to Introduction of Office Automation, op. cit., p. 1.

Also, unemployment among clerical workers is relatively low as compared with the total labor force. As indicated in Chart II-2, clerical unemployment averaged 3.7% in 1959, as compared to 5.5% for the total labor force.

CHART II-2

AVERAGE UNEMPLOYMENT PERCENTAGES, 1954-1959

Year	Percent Unemployed	
	Experienced Labor Force	Clerical Workers
1954	5.6	3.1
1955	4.4	2.6
1956	4.2	2.4
1957	4.3	2.8
1958	6.8	4.4
1959	5.5	3.7

Source: Bureau of Labor Statistics, May 1960.

From these figures we must conclude that the labor force has been, and still is, changing. Clerical workers have had fewer unemployment problems than the average blue-collar worker. From the time of the installation of the first computers there have been disagreements among various groups as to the amount of unemployment which would result. Many authorities in the field, such as John Diebold, indicate that their research points out that there will be only a shift in emphasis or types of jobs, and that no jobs would be lost due to office automation in the long run.[4] This same conclusion was published

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[4]John Diebold, (ed.), ADP Service Newsletter, November 30, 1959, p. 1.

by the Bureau of Labor Statistics in May 1960.[5] However, labor unions view with concern the trend of office as well as factory automation.

As of now there is not enough research information to determine whether the increased demand for clerical workers is from office automation or business growth. The indications are, however, that our total labor force is changing, and that more people are now employed in clerical positions. It must not be forgotten that computers open new areas of office activity and that they handle information which had previously been uneconomical to acquire.

The clerical worker of today and tomorrow must be ready for change. Many individuals who have spent their lives acquiring certain skills and have come to believe implicitly in their own indispensability are in for a rude shock. They will see machines accomplishing in seconds work that takes them days and weeks. These individuals will be forced to acquire new skills. In effect, the office is in a state of revolution, causing a change in the skill requirements of the clerical work force.

Nature of Jobs: Job Upgrading or Downgrading

One of the fears foremost in the minds of management and workers alike is that the use of computers would eliminate, or at best downgrade, human mental activities in the business world. Research findings in this area are just coming in. Experience to date has shown results on both sides of the ledger. Kenneth Galbraith states that "If there is

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[5]Bureau of Labor Statistics, Bulletin 1276, op. cit., p. 27.

competition between man and machines, man is winning out - not for at least two centuries has his position been so important as compared with that of the apparatus with which he works."[6] To put it another way, consigning the boring and tedious paperwork to machines has permitted a more effective utilization of manpower. Office employees have been released to do more interesting and creative work, so that their jobs have in fact been upgraded. Cases have shown, for example, that many company engineers used to spend half of their time doing routine mathematical computations and the other half in gathering data and evaluating results. Now since a computer has been installed eighty percent of their time is devoted to creative work and only twenty percent to routine calculations. Norbert Wiener also feels that the changes automation will bring to the working man are all good. He feels that the "human machine" is too complicated for such tasks as pasting labels on tin cans, or sorting and packing spears of asparagus, or tightening one or two bolts on a car on an assembly line. It is a degradation to a human being to assign him a purely repetitive task which demands less than a millionth of his brain capacity.[7]

Automation will lead us to "the human use of human beings" - that is, to our using man's specifically human qualities - his ability

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[6] J. K. Galbraith, "Men and Capital," The Saturday Evening Post, March 5, 1960, p. 27.

[7] American Management Association, Inc., Conference Results, Carter Hotel, Cleveland, Ohio, June 1957, p. 109. A paper presented by Norbert Wiener.

to think, to analyze, balance and synthesize, as well as to decide and to act purposefully.[8]

James Bright, on the other side of the ledger, found in his studies of thirteen plants with almost 50,000 employees, that "automacity does not necessarily result in a net upgrading of work-force skill requirements to a major extent. In fact, automation often tends to reduce the skill and training required of the workforce."[9]

Ida Hoos studied nineteen offices in the San Francisco Bay area and came to the same conclusion.[10] It is therefore apparent that while some workers have had their skill requirements raised as a result of automation, many have not. Dull, repetitive jobs have often been replaced by other dull, repetitive jobs.

Mind Versus Machine

Computers are not capable of thinking like the human mind. When it comes to solving any complex problem, human brain power is still all-important. Someone must conceptualize the problem, determine how it is to be solved, program the machine and then interpret the

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[8] Ibid.

[9] J. R. Bright, "Does Automation Raise Skill Requirements?," Harvard Business Review, July-August, 1958, p. 61.

[10] Ida R. Hoos, "The Impact of Office Automation on Workers," International Labor Review, October, 1960, pp. 363-388.

results. Even the average business, scientific or technical problem presents such a programming burden that it is itself much less complicated than its application to the machine.

Not only must the computer's operations be planned in advance by fairly high-level human thinking, but its results must finally be implemented by human decision-making. And nobody who is now using computers goes so far as to suggest that they will ever displace man in this vital step. If they do, however, we still have no real worry - we can always pull the plug.

Data-processing calls for a good deal of human effort and brain power, though for the most part it is on a relatively low level. Computers as of this time are not capable of handling original data. This problem will be solved in the future, but now a large percentage of our clerical labor is employed in preparing the data in a form the machine can utilize. There is still a vast amount of paperwork to be done in recording sales, orders, purchase orders, requisitions, invoices, and other original documents. In roads have been made in this field, such as magnetic ink for checks and prepunched sales tickets, but the mass of work still remains. As in problem solving, the effectiveness of the equipment depends on the accuracy of human programming and of human decisions about the machine-produced results, both of which must be highly accurate. In fact, the accuracy of data is now enormously more important than ever before. Once information is fed into the computer, errors that were not caught by the machine automatic checking devices, travel rapidly their various ways. This

creates a job of correction, that in some cases could use up the economics gained by use of the machine. According to one writer, "about one-third of the time of many high speed digital computers is used to eliminate errors from new programs. De-bugging is a necessary consequence of the fallibility of people and the literalness of computers."[11]

Today many people are concerned about the rapid advancements we have made in the computer field. Are we putting ourselves at the mercy of these electronic robots? This type of thinking is not new, it also prevailed back in the twenties. Karl Capek, a brilliant Czech playwright, invented the word "robot" in his play, R. U. R. (Rossm's Universal Robots). Radius, a bright robot, ultimately led a rebellious army of robots to a complete victory over the human race. Our computers today are not equal to Radius. However, future developments may someday give computers the ability to reason. Computer expert Frank Mathews half-seriously points out, "Our safeguard is that no matter how intelligent we are able to make computers, we can always reach down and pull out the wall plug. Of course we will have to make sure we don't supply the computer with an arm that could keep us from unplugging it, and we must not permit it to have an internal power source under its own control."[12]

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[11] C. R. Blair, "On Economical Debugging," Computers and Automation, May 1959, p. 18.

[12] Warren R. Young, "The Machines are Taking Over," Life, March 3, 1961, p. 27.

Social Changes

The office is a social as well as an economic unit. It is not just an organization to satisfy the needs of a business, but a human organization which contains the hopes and aspirations of individuals. Therefore, management has two basic functions to fulfill: the economic function- to manufacture or sell a product at a profit; and the social function - to keep individuals and groups of individuals working effectively together.

The size of the pay envelope is many times said to be the primary demand that the employee is making of his job. All the worker desires is to be told what to do and get paid for doing it. This concept was, in most cases, valid in the 1930's. Today, in our expanding economy, the average worker views his job in a different light. The one remaining major enterprise that carries on with this philosophy is the Lincoln Electric Company. Here the pay check is the dominating factor.

Since World War II we find a shift in the worker's outlook. There is no question that the size of the pay check has its importance, but it is not the only thing that the individual wants out of life. Most people want the satisfaction that comes from being accepted and recognized by their friends and associates as people of worth. Money is only a part of the recognition. Employees want job satisfaction which comes from being accepted and recognized by superiors, peers and subordinates. The greeting from a superior, being asked to help a

newcomer, being asked to keep an eye on a difficult operation, or being assigned a task which requires a special skill, are all examples of acts of social recognition. These satisfy the need and desire for tangible evidence of social importance. Everyone desires to be recognized as socially useful. Most people today desire the feeling of security that comes not so much from the amount of money in the bank, but from being accepted by members of a group.[13]

> Industry is not a machine, it is a complex form of human association. The true reading of its past and present in terms of human beings - their thoughts, aims and ideals - not in terms of systems or machinery. The true understanding of industry is to understand the thoughts of those engaged in it. The advance of science and the cult of efficiency have tended to obscure the fundamental humanity of industry ..... If the fundamental problem of industry can be reduced to the limits of a single question, that question would be: How best can we achieve and maintain a fair balance between the things of production - the machines, the buildings, the materials, the systems - and the humanity of production: the workers, the foremen, the managers and the shareholders? ..... While our industries have grown increasingly scientific we are denied the fruits of our efforts because we have failed to keep pace in the art of human leadership, understanding and cooperation. Pursuing things we have neglected men.....[14]

This statement is as true today as it was when it was written. However, as studies are conducted and as more experience is gained, not

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[13]F. J. Roethlissberger, Management and Morale, (Boston: Harvard University Press, 1958), p. 106.

[14]Olivery Sheldon, The Philosophy of Management, (London: B. A. Pitman and Sons, 1924), p. 89.

only by management but labor as well, progress can be made in finding the balance between man and machine.

Another highly important social aspect of office automation is the replacement of the worker in the humdrum work that Charlie Chaplin satirized in one of his films many years ago. "Automation" as Norbert Wiener aptly put it

> .....will lead to the human use of human beings, eliminating assembly-line work in factories and monotonous office drudgery in which man has hardly an opportunity to use his intelligence. Freed from this servitude, people will be able to devote themselves to creative work that calls for initiative. Workers will in any case be needed in factories, even in fully automated ones, but they will do a different job - either supervision and maintenance or else programming of the work to be done. Duties of this kind, however, will raise the workers status and give him greater importance and self-respect.[15]

Most experts now agree that automation will eliminate a whole stratum of dull, repetitive, low-paid jobs, both in factories and offices.

One day soon leisure time may become a major social factor. More leisure, it is hoped, will lead to higher education and higher cultural standards among the general public. Also, workers will have more time for sports, travel, entertainment and so on. Last year, Americans spent about $32 million on leisure goods and services - twice as much as for new automobiles and half as much as for food.

As automation increases, so will free time increase. This will

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[15]J. Garcia Santesmases, "A Few Aspects of the Impact of Automation on Society," Impact, Vol. XI, 1961, p. 46.

create many new social problems which up to now have not been faced. We must try and exert a wholesome influence on leisure-time activities with a view to broaden public culture so as to counteract the materialistic attitude which could result from a country dominated by automatic equipment.

New Meaning of Work

Whether for good or for evil, the effects of automation on so many individual employees have heightened the importance of good human relations within a company. It seems odd that the diminishing role of the human contribution in production has been accompanied by an increasing need for management to recognize the need to treat employees as both individuals and members of a group.

Management must never lose sight of the fact that work is the inescapable fate of the large majority of men and women. Despite the fact that in recent years the labor unions have been striving for more leisure time and less muscular output, work still remains almost the most important part of adult life. The impact of the workplace is found in almost every aspect of living.

A man's work is one of the most important things by which he is judged and undoubtedly is one of the most important aspects by which he judges himself. A man's job is what Everitt Hughes calls "a combination calling card and price tag."[16] When we meet a stranger,

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[16] J. H. Rohrer and S. Maizafer, (ed.), Social Psychology at the Crossroads, (New York: Harper and Brothers, 1951). The quote is from an article, "Work and Self," by Everitt C. Hughes.

normally we want to know the type of work he does. Our judgment of him is based, to a large degree, on an identification of his work. A press agent will describe himself as a "public relations counselor," the plumber is now called a "sanitary engineer," and the farmer becomes a "food producer." A Chicago restauranteur now calls his waitresses "hostesses," the hostesses "food service directors," the busboys "table servicemen," and the dishwashers "utensil maintenance men."[17]

These hedging statements in which people pick the most favorable of all the possible names for their jobs imply an audience, "and one of the most important things about any man is his audience, or his choice of several available audiences to which he may address his claims to be someone of worth."[18]

Automation removes any semblance of a "property" relationship between the producer and the product produced. As Peter Drucker says, "it is no longer the worker who is responsible for the final product,"[19] now it is the factory or office. The factory or office has become the unit of production and the worker does work - he does not produce the product. Many years ago in our society, shoemakers actually made shoes. Today workmen cannot say that they are making shoes - they operate or tend machines that make parts of shoes. This type of an operation certainly does not produce worker satisfaction.

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[17]"New Careers," Editors, Time, April 15, 1957, p. 19.

[18]Hughes, op. cit., p. 314.

[19]American Management Association, Inc., op. cit., p. 106.

The impact of the machine upon work and its meaning as stated by Adam Smith many years ago is certainly true now. "The understandings of the greater part of men are necessarily formed by their ordinary employments. The man whose life is spent in performing a few simple operations ..... has no occasion to exert his understanding..... He generally becomes as stupid and ignorant as it is possible for a human creature to become."[20]

F. W. Taylor's efforts to rationalize man's work also proved Adam Smith's earlier findings. In his experiments he reduced work to its simplest components and thus reduced the worker's opportunity to exercise judgment. In most cases the work produced by the worker doubled. However, he also prescribed the kind of worker who could best carry out these tasks as one who should be "stupid and so phlegmatic that he more nearly resembles an ox than any other type."[21]

Modern man today is alienated from his society. He suffers from a loss of roots. He finds little satisfaction from the world in which he lives. It is difficult for the worker today to achieve an identifiable status as in earlier times. A bookkeeper, a typist, a carpenter, a plumber and even a janitor had his own audience or status assigned in terms of his work. Now this status is described

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[20]Adam Smith, The Wealth of Nations, (New York: Modern Library, 1937), p. 734.

[21]Fredrick W. Taylor, The Principles of Scientific Management, (New York: Harper and Brothers, 1947), pp. 40-48.

by the identification not of his work, but from the organization for which he works.

The status requirements of today's worker must be satisfied by the company for which the work is performed; the community that supports the organization; and the physical things of life that money can buy. Management must not lose sight of the individual nor forget the new group relationships. The worth of a worker in our society is and will be judged on the basis of organization and planning and the continuously smooth functioning of the system as a whole. The individual worker loses some of his importance to the team which is operating the whole. W. H. Wyte's The Organization Man may indeed replace the traditional individualism which has characterized American society for so long.

CHAPTER III

PERSONNEL POLICIES AND AUTOMATION

The phrase "helping the computer" certainly has clear implications regarding personnel policies. Today greater premium must be placed on the speed and accuracy of the workers who handle the initial information. There also must be an excellent system of controls to police the raw data. The equipment manufacturers state how their machines have a checking feature built in, so that mistakes can be caught early in the process. This aspect only applies to the data that have been correctly put into the system. If a card is not punched correctly or coded properly with the program, then the machine will not indicate a mistake has been made.

All of the above points indicate that machines are not supplanting human thinking and judgment. These machines have made more effective use of these qualities. This can be pointed out by a story told by most computer salesmen when people become so overwhelmed by the computer that they fear they will take over the world. It seems a test pilot, while awaiting repairs to his test aircraft, walked into the design engineer's shop to see what the future had to offer. During the course of conversation the design engineer stated - "Well, it looks like you had better start looking for another job. We have

designed a computer that can land and takeoff any airplane." The test pilot smiled and said, "Well, maybe you are correct, but let me know when you have a computer that weighs less than 150 pounds; can see, hear, feel, smell and speak; can rationalize and make decisions under varying conditions; and can be produced by such cheap, unskilled labor, and then I shall worry."

The continuing importance of the workforce has been demonstrated in still another way. Successful applications of the machines to routine business functions - the sphere in which they produce the greatest impact - has often been dependent on the re-education of the people concerned. Most companies today look upon the initial period of the computer's operation as one of experimentation and education; that is, in fact subsidized by the machine itself. Strangely enough, in many cases the greatest savings have been accomplished through the improvement of regular operations rather than through the use of the machines. Thus, the computers have been more effective for companies that are already well organized and well managed. The greatest benefit derived by a poorly organized and managed company is the reorganization which results from a thorough feasibility study.

Displacement or Unemployment

Automation will affect personnel in one way or another. It will affect the type of work being done and the way men lead their lives. Whether it comes quickly or slowly, the key question in the minds of most people is: "How will it affect my job?"

Labor unions and management are as one in agreeing that in the long run automation is the key to some of labor's chief goals: the shorter work week, higher wages, and better working conditions. All of the Congressional subcommittees that have investigated automation made particular note of the fact that not a single witness raised a voice in opposition to automation and advancing technology. This was true of the representatives of organized labor, as well as of those who spoke from the side of management.

However labor, while it realizes that the long-run prospects are bright indeed, is very fond of quoting Lord Keynes' remark that "in the long run, we are all dead."[1] The problem before us, James B. Carney, President of the International Union of Electrical Workers, has argued, "is not whether we are for or against automation ..... The problem is whether or not the American people and our free society will be subjected to vast dislocations during the coming ten to twenty years, when the automatic operation of many industrial and clerical processes will be introduced."[2]

Peter F. Drucker has suggested the "automation may bring about more large-scale labor displacement in office jobs than in any other field of employment."[3] His statement shows the delineation that must

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[1]Hearing, Impact of Automation on Employment, op. cit., p. 146.

[2]Ibid.

[3]Wall Street Journal, March 19, 1960, p. 3.

be made between displacement and unemployment.

Predictions made in 1955 indicated that the introduction of computers would produce widespread unemployment. But the history of mechanization in general, as many people have pointed out, is paradoxical in the initial unemployment, and has always been succeeded by a far greater volume of employment opportunities than existed under the slower methods. Of all the new industries which have sprung up in the past seventy years, fourteen alone (and these are among the most highly automated of all) provide employment for over thirteen million people. This is not to say that there will not be unemployment and displacement problems during the automation phase of the industrial shift. Many labor leaders feel that the increase in automation since 1945 has caused our present increase in the hard core of unemployed. This certainly has a bearing on the problem, but it should be remembered that other factors also affect this so-called hard core.

New workers at the rate of approximately two million are entering the labor force each year. Advances in medical science has also made it possible for people to work longer and stay healthier in the process. Automation has affected the unemployment situation, but not to the extent that most labor leaders would have us believe. Also, in the past ten years there has been a shift of industry from certain high cost areas of the country to areas of lower operating and labor costs.

Do not confuse displacement with unemployment. To date, the only apparent connection between computer and office unemployment is through labor displacement when employees fail to adapt to new jobs

and new opportunities. Actual office unemployment as a result of computer installation is relatively uncommon. Even with the rapid spread of office automation, there is little likelihood that any substantial number of people will be thrown out of work. The Bureau of Labor Statistics studies of automation and technological change has concluded that "there has been a tremendous amount of displacement of workers, not necessarily permanent unemployment, but certainly displacement of workers; displacement of women, older people, minority groups, and people who have a harder time getting a new job, those who are the first to be laid off and the last to be rehired. Within plants and offices studied, there has been a lot of internal shifting, and very few major layoffs."[4] In fact, as stated earlier, the trend thus far has been in the opposite direction. In 1950, clerical workers accounted for 12.5% of the total workforce. In March 1959, the percentage had increased to 14.2% and now the percentage is 14.3%. Of course, the labor unions are saying that this increase is accounted for mainly by the reduction in the blue-collar workforce, which is a change far greater than the relative increase in the clerical workforce. But the absolute number of office workers has been growing, and in 1959, for example, there were 100,000 more of them than in the previous year.

The Realities

Many employees have suffered, and will continue to suffer,

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[4] Hearing, Impact of Automation on Employment, op. cit., p. 86.

as a result of the increase in manual and mental requirements caused by the shift to automation. They suffer not from unemployment, but movement or transfer within their companies. "Recent industry and government surveys found that less than 3% of the office employees whose jobs were eliminated or integrated had been laid off. When asking about the effects of introducing electronic data-processing, 42% of the companies said no jobs had been replaced; 54% said that the affected employees had been integrated into other jobs; 2.7% had to lay off employees; and less than 1% had transferred employees to other locations."[5]

The transition from non-computer to computer operations has been eased by two factors: the need for clerical personnel that is imposed by the rapidly increasing volume of paperwork, and the current high turnover rate in the clerical workforce.

The shift to computer operations has worked to the benefit of the many employees for whom the process of upgrading has brought not only higher pay, but an opportunity to transcend the clerical status ladder and achieve a measure of professional standing. Many others have found the computer to be a stepping stone to higher positions in their own office or in other companies.

It is equally true, however, that many of the retained employees are not mentally or emotionally capable of fitting into these new

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[5]"Office Automation: How Much Staff Dislocation?", Personnel, January-February, 1960, pp. 4-5.

jobs. These new jobs require different talents and techniques, as well as new arrangements or structures of duties and responsibilities. Most studies to date show that the most troublesome personnel relocation problems have been with people experienced in routine work and inexperienced in making value judgments and decisions. Usually the older and less educated employees tend to be relatively inflexible and unable to readjust to a changing office routine.

As has been the case since the industrial revolution, labor has taken one extreme point of view and management has taken the other. Office automation, up to this time, has not created a serious unemployment problem. The increased demand for information about the business enterprise has created new demands on the office worker. During the past fifty years, paperwork has increased due to management demands and increased government regulation of business. Even complete office automation will not win the victory over paperwork.

Responsibilities of Management

There is an old adage that says "you can't teach an old dog new tricks." It has been a problem for management ever since recorded history. People are basically opposed to change, particularly those changes which have an effect on their way of life. The average person is willing to accept advancement, because it represents an advancement in the social strata of the group and sets up new challenges. However, if there is a possibility that his security is questioned, if his standard of living is affected, if his social position is in jeopardy,

then he opposes change. Some of the reasons for this opposition are not readily recognized, but then human behavior is far from being simple. Basic fears aroused by change are not really new. A century and a half ago the beginning of the industrial revolution in Europe stirred workers to the point that they threw wooden shoes into the automatic looms and smashed other new machinery with sledge hammers. A cartoon, drawn in 1830, depicted all the possible disasters that would result from the introduction of steam power into factories. It even went so far as to recommend that mothers stop having children, since this new energy steam would take away any possibilities of jobs for them.[6]

Good personnel administration can be the key to the problem of opposition to change. For the most part the worker is against change because he does not completely understand the new system or why the change is being made. When problems develop, we find that management has not taken the time nor the trouble to explain the why's and wherefor's of the new system. Too many times management just takes for granted that everything will work itself out. Our workforce today is relatively highly educated and informed. They want to know how the change will affect them as individuals and as a group. The following case, related to me by Dr. Thomas Horton, Director of Marketing Services, International Business Machines Corporation, illustrates the point. Technical personnel were hired to install an electric accounting

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[6] "Automation - Friend or Foe," General Electric Employee Relations Newsletter, April 8, 1955.

system. The hired "experts" knew nothing about the business nor the procedures of the company. In one of the early conferences leading to the installation of the new system, the senior technician made a statement to the effect that after the new computer was installed, the company would be able to hire nothing but morons. The reaction on the part of the employees should be obvious. They were so incensed that nothing could change their minds about the value of the new system. They were so strong in their opposition that management has forced to abandon the whole idea and stick to their present system. This is strictly a case of lack of communication and education of personnel involved in the changes. Such administrative behavior can lead only to dismal failure.[7]

Management must now, more than ever, keep employees informed as to the changes contemplated. Everyone fears the unknown. Computers have been played up so that the average worker has a conditioned reflex of fear for his job and his well-being. Headlines in the papers such as "Automation Causing Increase in Unemployment Hard Core," "Machines Take Jobs," et cetera, create the need for management to plan an educational program to keep the worker informed at all times. In darkness there is fear, because we cannot see the unknown. We all possess fear of the unknown in varying degrees.

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[7]Interview with Dr. Thomas Horton, Ph.D., Director of Marketing Services, Federal Systems Division, International Business Machines Corporation, Washington, D. C., February 7, 1962.

CHAPTER IV

THE NEW REQUIREMENTS

Management has provided all sorts of social shock absorbers for workers displaced by automation - severance pay, dislocation pay, pensions (including provisions for earlier retirement), unemployment insurance, guaranteed employment or wages (including supplemental unemployment compensation payments), and so forth. Even though these shock absorbers are provided by management, the unions have had a lot to do with establishing the policies in the early phases of automation. Most union contracts after 1950 had many of these provisions.

That office workers may share in the benefits of automation, the unions have attempted to obtain a stronger guaranteed annual wage, a shorter work week, new job classifications, assurance that inter-office transfers will be based solely upon senority, and the like. In addition, they have intensified their efforts to unionize this increasingly important segment of the labor force.

While everyone recognizes that the modification in work patterns has manifested itself in changing skill requirements and job content, there is no agreement on which direction these elements have taken - that is, on whether they have become narrower or broader, more rigid or more relaxed.

On one hand, any sort of mechanization inevitably produces some sort of specialization of jobs. As machinery is endowed with the skills formerly demanded of men, it comes to determine the quality and quantity of the work produced. The worker becomes the servant of his machine, and his job is defined by it. Computers, because they are highly complex machines, must be tended by a corps of specially trained workers. Thus management has been compelled to place a much greater reliance upon staff specialists than ever before.

On the other hand, the training and improved working conditions that accompany mechanization heighten the worker's effectiveness and can therefore upgrade his job or add to its content. As indicated earlier, some jobs are upgraded because of the computer and some are downgraded. A blanket statement cannot be made. All situations will vary and have to be analyzed individually. Many researchers believe that the demand for computers and the need to reorganize our economy around automation will produce an immense increase in diversification and adaptability on the part of the individual employee.[1] Narrow and rigid job classifications, they point out, have had to be broadened and relaxed and may even be eliminated in the future. The prediction seems inconsistent with the history of mechanization in general, but it is based upon two sound observations: First, the current trend in management thinking is away from minute specialization and toward

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[1] M. D. Witty, "Obsolete - at Age 29," Computers and Automation, December 1958, pp. 26-28.

generalization. Management has begun to think in terms of the whole organization rather than of its components, and to look at relationships analytically rather than to rely on a "feel" for the particular situation. One result of this is the growing demand for managerial people with an over-all view of the business enterprise.[2] "If widening the scale and variety of a company's internal activities were simply to require a different kind of individual top management, the problem would be difficult enough, but the need for balancing and coordinating a diversity of functions reaches down to many lower-level activities."[3]

Secondly, the very nature of computer operations demands some generalization of effort. Activities that were formerly handled in the production, sales, finance, and other departments, by their own personnel, are now the responsibility of the computer center. These computer employees now must have a breadth of knowledge and training. For example, in many companies the sales forecast, inventory control and plant location problems are now handled by the computer center. According to Harold Leavitt and Thomas Whisler of the University of Chicago, the computer will have four effects on management: planning will be transferred from middle management to top level specialists;

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[2]R. A. Gordon and J. E. Howell, Higher Education for Business, (New York: Columbia University Press, 1959), p. 80.

[3]F. C. Pierson, The Education of American Businessmen, (New York: McGraw-Hill Book Company, Inc., 1959), p. 90.

large industrial organizations will recentralize with more of the creative functions being taken on at the top level; there will be a radical reorganization of middle management; and the line separating the middle and top management levels will be more sharply drawn.[4] Most of the experts agree that this centralization of processing activities will lead to more specialization and centralization of the management function. It is hard to believe that anyone could differ with this idea. During the past few years, many companies have utilized the Controller's ability to see the "big picture" and in many cases have made him the president of the company. The prime example of this is the present Secretary of Defense, Robert McNamara.

How will these trends be manifested in the changing composition of the workforce? When speculating about the new kind of organizational world that will inevitably be created by the use of electronic computers, it is recognized immediately that while jobs in the higher echelons will demand a high degree of skill and diversification, there will be many relatively routine jobs requiring little skill, such as key-punch operators, machine tenders, and the like. It must also be recognized that workers at the lower levels will be frozen in their jobs - a condition that is to be avoided as far as possible.

There is, of course, a certain inflexibility that goes hand-in-hand with the complexity of computer operations. Intensifying this inflexibility

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[4]Harold Leavitt and Thomas Whisler, "Management in the 1980's," Harvard Business Review, November-December 1958, pp. 41-48.

is the fact that computers are creating a higher ratio of maintenance people to production people, and of management people to non-management people. Because indirect labor is thus growing in importance, employment is becoming less tied to the business cycle. This was demonstrated by the lag in employment for a few months after the turn of the 1958-1959 recession. Many companies anticipated further investment in automation and hence were cautious about rehiring. One of the nation's top executives was quoted by New York financial columnist Sylvia Porter, "I'd rather have our employees work a longer week and pay overtime than add one more man than necessary to the payroll..... It's cheaper to pay the extra expense of overtime."[5] In unionized companies, this change in employment ratios has also produced a widening in the concept of seniority units to include plantwide or even companywide seniority.

The Trend Toward Generalization

Now that the trend is away from worker specialization and toward generalization, management, labor and government must meet these new requirements. The social shock absorbers, discussed earlier, are certainly not the answer. Office workers who are displaced must be trained to meet the high demands placed upon them by the computer. Most corporations try to utilize their own personnel to fill new jobs created by office automation. However, there is no definite policy

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[5] New York Times, March 10, 1959, p. 26.

or trend in this direction. The only answer seems to be a joint effort by management, labor and the government to retrain and educate the displaced persons. Congress is presently working on a bill which will help train displaced persons with the money they would normally receive from unemployment compensation. This certainly is a step in the right direction, but it still requires the full support of management and labor.

The Time Factor

Another new management problem imposed by computers is a drastic rescheduling of work for two reasons: first, there must be both preventive and curative maintenance. The former has proven to be much more economical of time than the latter. And secondly, as fast as computers are, there is a limit to the amount of work they can do simultaneously. Something has to go first, something has to follow, and something has to go last. This obvious limitation has probably been the root of more dissatisfaction with computers than any single factor. The cost of the computer is thought of in time and utilization. Since these costs are high, the computer must not be permitted to remain idle. As the workload increases in relation to its capacity, some of it must be performed outside the regular 8-to-5 shift - a new and frustrating experience for most clerical workers.

Supervision now takes on a more important role. Because the economical operation of the computer depends upon the efficiency of the staff that controls it, the supervision of personnel has assumed

even greater importance than in the past. Not only does the computer need a new kind of worker with different vocational qualifications and skills, but its technical and organizational characteristics also call for a new kind of manager. He must be one who can fit the changing types of technical personalities and employees into the organization and yet maintain the morale of the old workers, who are finding it increasingly difficult to perceive their individual contribution to production.

Management Education

What managerial characteristics does this job require? In describing the search for a director for General Electric's Computer Center, R. F. Osborn writes, "We were looking for high intelligence and ability to think logically and reason abstractly. In particular, for the leadership of such a group, we wanted someone with enthusiasm, vision, foresight, energy, and optimistic point of view; he should be willing to take risks and devote his entire energies and thoughts to the task at hand."[6] Such a selection of traits is frequently dictated by the need for re-evaluating the existing clerical system and designing a new one in accordance with the most advanced thinking in the field.

Dr. Walter Buckingham has stated that "The education for industrial leadership will have to place its main emphasis on developing the tools

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[6]R. F. Osborn, "G. E. and Univac: Harnessing the High-Speed Computer," Harvard Business Review, July-August, 1954, p. 99.

of analysis. This will require that primary attention be given to developing: mental flexibility; the ability to think creatively; the skills for thinking logically, analytically and qualitatively; and develop a receptiveness of new ideas."[7] It will be less important to teach specialized subject matter, especially information pertaining to business practices. We cannot be sure what the future requirements will be, but most certainly they will differ from today. Today's facts will then be obsolete and of historical interest only.

Perhaps a few generalizations as to the future might be ventured. First, there will be continued growth both in size and complexity of American business. Secondly, the managerial functions will become more professionalized due to the complexities and the separation of ownership from control. Thirdly, the economic objectives of business will be meshed with the social objectives. Fourthly, managers will no longer manage "by the seat of their pants." The computer will take out most of the hunches and guesswork presently used to solve complex problems. Consequently, management will move closer and closer to becoming a science. It will not be in the mechanistic sense of the early twentieth century scientific management, but in a broader, more sophisticated sense that recognizes the limitations of applying the scientific method to human relations, economic theories and behavioral science.

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[7]Walter Buckingham, Automation, Its Impact on Business and People, (New York: Harper and Brothers, 1961), p. 70.

Then, management education will have to fall into four general areas.[8] The first area might be called the traditional area of organization and administration. The problems to be solved will involve both organizational and administrative relationships arising from the large industrial organizations. It will entail getting things done through people and inducing loyalty to and identification with the organization. The worker will be tied to the organization, not to the job, as in the past.

The second area will be economic management. Here the manager must operate in theories. He must use his analytical tools to ensure the efficient use of the elements of production: labor, capital equipment, natural resources, raw materials, as well as the money needed to acquire them. Also, he must ensure that all courses of action are consistent with the objectives of the company.

The third area is the market environment. All organizations must buy human, physical and financial resources, as well as sell its finished products. As the industrial enterprise grows in size and becomes more automated, the marketing function becomes more and more important. It will not be as easy to slow down production or shift to another product.

The fourth area is social and economic environment outside of the market place. Its elements are many and include all forces which

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[8]Gordon and Howell, op. cit., pp. 62-63.

may, in any way, touch upon the business enterprise, such as the political structure, legal aspects, economic forces, technological progress and pressures of society.

All the trends appear to point toward the need for a broad, analytical education for both top management and middle management as well. Fortunately or unfortunately, there is no one "right" way to program a computer. However, not all ways are equally efficient, and some can be very wasteful of time and effort. Therefore, the broad analytical education is a must, so that all available methods will be explored.

The Manpower Hunt

There is a tremendous need for manpower skilled in operating computers. This need has been a major check on progress in their installation. Not only did a manpower shortage prevail during the early years of computer operations, but the number of available professional positions has outstripped the supply of trained personnel even during the last five years. The law of supply and demand is still valid. As one personnel manager put it, "seek (and pay ye well enough) and ye shall ultimately find."[9]

Conversion to computer operations thus demands frequent adjustments in job evaluations and wage structures as well as in organizational plans. Many companies have found themselves paying

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[9] L. E. Stoter, "Instrumentation," Office Executive, October 1959, p. 46.

their bright young computer experts as much as, or even more than, old-time employees. Naturally in many cases strained relations result.

To avoid this situation, as well as other problems, many companies have looked within their own company for the people necessary to man the computers. This, of course, forces the company into training its own personnel. Now retraining assumes much greater importance in personnel management than ever before. This training is given to many kinds of employees - from clerical upwards. For example, of the forty men at Texaco's Port Arthur refinery who can use FORTRAN, many were formerly chemical engineers.[10] Most companies establish committees of their own people to do as much survey work as possible, so that they can gain experience. For the most part, the training programs consist primarily of on-the-job training, supplemented by short courses given by the manufacturer of the equipment and by universities.

The use of outside sources of employees has involved much pirating of personnel from the computer manufacturers, other computer users, the government, and university faculties. However, the practice has had one favorable consequence. It has brought the problem out into the open and programs for computer training in the colleges and even high schools has resulted. Most certainly in the future, the

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[10]"Educating the Big Computers," Business Week, June 13, 1959, pp. 74-76.

training job for the most part will be performed mainly by universities in regularly scheduled graduate and undergraduate courses and programs. According to one authority, Dr. G. M. Jones, the educational bits and pieces provided so far "are giving way gradually to better organized, systematic instruction ..... at least present developments and announced plans in many schools point in that direction."[11] For these schools to do an effective job, however, it may be necessary to alter the curriculum of the secondary schools and particularly their mathematical requirements.

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[11] G. M. Jones, "Computer Education: Dilemna of the Colleges," Proceedings of the High-Speed Computer Conference, Louisiana State University, 1957, p. 11.

CHAPTER V

CONCLUSIONS

This is an age of scientific and technological revolution. New labor-saving devices, management concepts and skill requirements are evolving at a rapid pace. The traditionally established precepts are falling by the wayside at an increasing rate. Office automation is definitely on the increase and offers a multitude of problems and challenges to management, labor and government.

Automation promises the elimination of routine and repetitive jobs. In the long run, it will make possible the creation of greatly improved working conditions and the eventual reduction in the length of the work-week. These improvements will undoubtedly lead to a higher standard of living and will offer economic, social and intellectual rewards never before possible.

However, this bright picture is somewhat dimmed by the short run or immediate effects. Even during periods of high employment, the introduction of an office computer will likely result in lay-offs and in most cases an upgrading of the level of skills required in the work force. Therefore, management, labor and government must cooperate and help the displaced worker to adjust to this new environment. As

automation increases its hold on society, workers become more flexible and better educated.

Many of the fears voiced in the past have not been vindicated. Office automation will not eliminate human thought or control. The computer will assist the worker of the future in accomplishing the increased demands placed upon him. We can look forward to a future with fewer people doing things that only people can do. It is clear that these favorable consequences can be secured only through cooperation and long-range planning by management, labor and government, or, in fact, by society as a whole. This will ensure that the transition to the era of the new technology is accomplished with a minimum of social dislocation and human suffering.

In the future as electronic computer systems develop, there will be a spreading pattern of the substitution of machines for clerical workers. Due to the present and projected demand, most of these workers will not be laid off. However, it does appear that not as many new workers will be hired, since the opportunities for the office worker will be most certainly curtailed. The machines are just beginning to fill the gap between supply and demand.

There will be increasing demands on the office worker. He is gradually changing into a versatile technician with an understanding of the overall business enterprise. Changing equipment and methods will alter operations and job requirements faster than has been experienced in the past. The office worker will be the center of these developments and gradually a higher caliber of man is going to

be needed in this field. Management, labor and government will soon establish programs to develop the high aptitudes and initiative required in the years ahead.

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